

Metallic packing is invariably used. In the case of the high-pressure cylinder it is usually of the double type. This detail is never made by the engine builders themselves, but is supplied by firms who specialize in its manufacture.

To prevent oil being carried out of the crank-case by the piston-rod, a wiper gland is provided, fixed in a diaphragm in the distance piece in order that oil may not be sucked into the low-pressure cylinder by the vacuum. It is necessary that the distance pieces shall have height sufficient to prevent any part of the piston-rod which comes in contact with oil entering the low-pressure gland. Oil from the wiper glands and water from the cylinder glands collect in the bottom of the distance piece, and the mixture is drained away to a common pipe fixed inside the crank-case, and thence to a pocket or sump in the bedplate where it is dealt with by a special form of separator, to be described later.

**Frames.**—In good-class work the frames and the bedplates, even in the smallest sizes, are always separate castings. It may be remarked that the former is often referred to as the crank-case. Its chief function is, of course, to connect the cylinders to the bedplate through the distance piece, but it also encloses the working parts and so prevents oil being splashed about. The material is subject to tensile strains during the downward movement of the piston. The thickness of the metal is determined to a great extent by foundry considerations, so that there is always ample material to resist tensile strains. Further, if the casting is too thin but yet of ample strength, an unpleasant "drumming" noise is caused when the engine is running. For this reason, apart from considerations of strength, all flat surfaces should be well ribbed. The horizontal flat top of the crank-case which supports the distance pieces should be thickened to take the studs for the distance pieces, and well reinforced inside by transverse ribs in the neighbourhood of the distance-piece stud circles. These ribs may be carried down each side of the crank-case inside, gradually decreasing in depth towards the bottom. The whole of the metal in the section of the crank-case between

the ribs, including the depth of the ribs themselves, may then be regarded as resisting the steam forces on the piston.

Some triple-expansion engines have three doors, one opposite each line. This perhaps adds to the convenience of inspecting, but the metal of the crank-case above the doors is subject to bending stress, and the section and depth of the metal should be sufficient to make this very low. It is better to have the doors between the crosshead guides, as it is then possible to have a continuous section right down to the bottom flange of the crank-case.

The bottom flange for attaching the crank-case to the bedplate is usually heavy, in order that there may be no spring between the studs, which may be a little greater in diameter than the studs for the cylinders and pitched 7 to 8 diameters apart. For the largest engines the crank-case is often divided into an upper and a lower portion for convenience in manufacture and transport.